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(57) **ABSTRACT**

A microfabricated electron phase shift element is used for modifying the phase characteristics of an electron beam passing through its center aperture, while not affecting the more divergent portion of an incident beam to selectively provide a ninety-degree phase shift to the unscattered beam in the back focal plane of the objective lens, in order to realize Zernike-type, in-focus phase contrast in an electron microscope. One application of the element is to increase the contrast of an electron microscope for viewing weakly scattering samples while in focus. Typical weakly scattering samples include biological samples such as macromolecules, or perhaps cells. Preliminary experimental images demonstrate that these devices do apply a ninety degree phase shift as expected. Electrostatic calculations have been used to determine that fringing fields in the region of the scattered electron beams will cause a negligible phase shift as long as the ratio of electrode length to the transverse feature-size aperture is about 5:1. Calculations are underway to determine the feasibility of aspect smaller aspect ratios of about 3:1 and about 2:1.

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